

## NATIONAL QUALITY FORUM—Evidence (subcriterion 1a)

**Measure Number** (if previously endorsed): 0280

**Measure Title:** Dehydration Admission Rate (PQI 10)

**IF the measure is a component in a composite performance measure, provide the title of the Composite Measure here:** Click here to enter composite measure #/ title

**Date of Submission:** Click here to enter a date

### Instructions

- For composite performance measures:
  - A separate evidence form is required for each component measure unless several components were studied together.
  - If a component measure is submitted as an individual performance measure, attach the evidence form to the individual measure submission.
- Respond to all questions as instructed with answers immediately following the question. All information needed to demonstrate meeting the evidence subcriterion (1a) must be in this form. An appendix of supplemental materials may be submitted, but there is no guarantee it will be reviewed.
- If you are unable to check a box, please highlight or shade the box for your response.
- Maximum of 10 pages (includes questions/instructions; minimum font size 11 pt; do not change margins).  
**Contact NQF staff if more pages are needed.**
- Contact NQF staff regarding questions. Check for resources at [Submitting Standards webpage](#).

**Note:** The information provided in this form is intended to aid the Steering Committee and other stakeholders in understanding to what degree the evidence for this measure meets NQF's evaluation criteria.

### 1a. Evidence to Support the Measure Focus

The measure focus is evidence-based, demonstrated as follows:

- **Health outcome:** <sup>3</sup> a rationale supports the relationship of the health outcome to processes or structures of care. Applies to patient-reported outcomes (PRO), including health-related quality of life/functional status, symptom/symptom burden, experience with care, health-related behavior.
- **Intermediate clinical outcome:** a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence <sup>4</sup> that the measured intermediate clinical outcome leads to a desired health outcome.
- **Process:** <sup>5</sup> a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence <sup>4</sup> that the measured process leads to a desired health outcome.
- **Structure:** a systematic assessment and grading of the quantity, quality, and consistency of the body of evidence <sup>4</sup> that the measured structure leads to a desired health outcome.
- **Efficiency:** <sup>6</sup> evidence not required for the resource use component.

### Notes

3. Generally, rare event outcomes do not provide adequate information for improvement or discrimination; however, serious reportable events that are compared to zero are appropriate outcomes for public reporting and quality improvement.
4. The preferred systems for grading the evidence are the U.S. Preventive Services Task Force (USPSTF) [grading definitions](#) and [methods](#), or Grading of Recommendations, Assessment, Development and Evaluation ([GRADE](#)) [guidelines](#).
5. Clinical care processes typically include multiple steps: assess → identify problem/potential problem → choose/plan intervention (with patient input) → provide intervention → evaluate impact on health status. If the measure focus is one step in such a multistep process, the step with the strongest evidence for the link to the desired outcome should be selected as the focus of measurement. Note: A measure focused only on collecting PROM data is not a PRO-PM.
6. Measures of efficiency combine the concepts of resource use and quality (see NQF's [Measurement Framework: Evaluating Efficiency Across Episodes of Care](#); [AQA Principles of Efficiency Measures](#)).

**1a.1. This is a measure of:** (should be consistent with type of measure entered in De.1)

Outcome

- ☒ Health outcome: [Admission to an acute care hospital](#)
- ☐ Patient-reported outcome (PRO): Click here to name the PRO  
*PROs include HRQoL/functional status, symptom/symptom burden, experience with care, health-related behaviors*
- ☐ Intermediate clinical outcome (e.g., lab value): Click here to name the intermediate outcome
- ☐ Process: Click here to name the process
- ☐ Structure: Click here to name the structure
- ☐ Other: Click here to name what is being measured

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**HEALTH OUTCOME/PRO PERFORMANCE MEASURE** *If not a health outcome or PRO, skip to 1a.3*

**1a.2. Briefly state or diagram the path between the health outcome (or PRO) and the healthcare structures, processes, interventions, or services that influence it.**

Dehydration is a serious acute condition that occurs mostly in elderly patients and patients with other underlying illnesses. Dehydration for the most part can be treated in the outpatient setting. Dehydration is often preventable through attention and support for fluid intake, especially in patients at risk.<sup>1,2</sup> Those at risk includes, but is not limited to, individuals with cognitive or psychiatric disorders, increased age, co-morbid illness requiring medications such as diuretics or laxatives, polypharmacy, diabetes, acute gastroenteritis, and living in areas with extreme heat.<sup>3,4,5</sup> Dehydration is treatable with oral rehydration therapy and/or intravenous (IV) fluids and by addressing the underlying cause.<sup>1,2</sup> If left untreated, serious complications are possible, including acute kidney injury and mortality.<sup>1,2</sup> Clinical interventions may prevent serious complications. Examples of such interventions include phone triage and education to promote oral rehydration,<sup>1,6</sup> early detection of dehydration,<sup>2</sup> and providing rapid access to treatment for those at highest risk.<sup>7</sup> Community interventions include air conditioning for the elderly during intense heat waves.<sup>8</sup>

1. Menten JC. Managing oral hydration. In: Boltz M, Capezuti E, Fulmer T, Zwicker D, editor(s). Evidence-based geriatric nursing protocols for best practice. 4th ed. New York (NY): Springer Publishing Company; 2012. p. 419-38.
2. American Medical Directors Association (AMDA). Dehydration and fluid maintenance in the long-term care setting. Columbia (MD): American Medical Directors Association (AMDA); 2009.
3. Wakefield BJ, Menten J, Holman JE, Culp K. Risk factors and outcomes associated with hospital admission for dehydration. *Rehabilitation Nursing*. 2008;33(6):233-241.
4. Jiang HJ, Wier LM, Potter DEB, Burgess J. *Hospitalizations for Potentially Preventable Conditions among Medicare-Medicaid Dual Eligibles, 2008*. Rockville, MD: Agency for Healthcare Research and Quality; 2010.
5. Khalaj B, Lloyd G, Sheppard V, Dear K. The health impacts of heat waves in five regions of New South Wales, Australia: a case-only analysis. *International archives of occupational and environmental health*. Oct 2010;83(7):833-842.
6. Hazratjee N, Agito M, Lopez R, Lashner B, Rizk MK. Hospital readmissions in patients with inflammatory bowel disease. *The American journal of gastroenterology*. Jul 2013;108(7):1024-1032.
7. Konrad D, Corrigan ML, Hamilton C, Steiger E, Kirby DF. Identification and early treatment of dehydration in home parenteral nutrition and home intravenous fluid patients prevents hospital admissions. *Nutrition in clinical practice : official publication of the American Society for Parenteral and Enteral Nutrition*. Dec 2012;27(6):802-807.
8. Ostro B, Rauch S, Green R, Malig B, Basu R. The effects of temperature and use of air conditioning on hospitalizations. *Am J Epidemiol*. Nov 1 2010;172(9):1053-1061.

**1a.2.1. State the rationale supporting the relationship between the health outcome (or PRO) to at least one healthcare structure, process, intervention, or service (i.e., influence on outcome/PRO).**

Dehydration can be prevented by increased surveillance of patients at risk in the outpatient setting along with early identification and intervention. Patients with poor access to primary care providers, may seek treatment later, have less access to telephone triage and health education to support home-based management, and may be more likely to seek emergency care.

**Note:** For health outcome/PRO performance measures, no further information is required; however, you may provide evidence for any of the structures, processes, interventions, or service identified above.

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## INTERMEDIATE OUTCOME, PROCESS, OR STRUCTURE PERFORMANCE MEASURE

**1a.3. Briefly state or diagram the path between structure, process, intermediate outcome, and health outcomes.** Include all the steps between the measure focus and the health outcome.

**1a.3.1. What is the source of the systematic review of the body of evidence that supports the performance measure?**

- ☐ Clinical Practice Guideline recommendation – **complete sections [1a.4](#), and [1a.7](#)**
- ☐ US Preventive Services Task Force Recommendation – **complete sections [1a.5](#) and [1a.7](#)**
- ☐ Other systematic review and grading of the body of evidence (e.g., *Cochrane Collaboration*, *AHRQ Evidence Practice Center*) – **complete sections [1a.6](#) and [1a.7](#)**
- ☐ Other – **complete section [1a.8](#)**

Please complete the sections indicated above for the source of evidence. You may skip the sections that do not apply.

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## 1a.4. CLINICAL PRACTICE GUIDELINE RECOMMENDATION

**1a.4.1. Guideline citation (including date) and URL for guideline (if available online):**

The guidelines cited here provide processes to identify and treat hydration in order to prevent severe dehydration and other serious consequences. If severe dehydration is prevented it is assumed that hospitalization rates would be reduced.

NGC:009717 Menten JC. Managing oral hydration. In: Boltz M, Capezuti E, Fulmer T, Zwicker D, editor(s). Evidence-based geriatric nursing protocols for best practice. 4th ed. New York (NY): Springer Publishing Company; 2012. p. 419-38. (more detail in 1a.4.2)

Additional guidelines:

NGC:008652 Menten JC, Kang S. Hydration management. Iowa City (IA): University of Iowa College of Nursing, John A. Hartford Foundation Center of Geriatric Nursing Excellence; 2011 Apr. 43 p. [136 references]

NGC:007636 American Medical Directors Association (AMDA). Dehydration and fluid maintenance in the long-term care setting. Columbia (MD): American Medical Directors Association (AMDA); 2009. 29 p. [60 references]

**1a.4.2. Identify guideline recommendation number and/or page number and quote verbatim, the specific guideline recommendation.**

The following guidelines are included in Menten JC. Managing oral hydration. In: Boltz M, Capezuti E, Fulmer T, Zwicker D, editor(s). Evidence-based geriatric nursing protocols for best practice. 4th ed. New York (NY): Springer Publishing Company; 2012. p. 419-38. Evidence is graded by levels of evidence (**I–VI**), defined in 1.4.3.a.

Two types of guidelines are quoted from this source below. The first focuses on important practices related to the assessment and evaluation of patients to facilitate the identification of at risk patients and early identification of dehydration (Includes Parameters of Assessment and Risk Identification. The second type of guideline focuses on management of hydration to prevent and treat dehydration (Includes Acute Hydration Management, Ongoing Hydration Management, and Follow-up Monitoring).

Quoted text:

**Parameters of Assessment** (Mentes & Iowa-Veterans Affairs Nursing Research Consortium [IVANRC], 2000 [**Level I**])

Health history

- Specific disease states: dementia, congestive heart failure, chronic renal disease, malnutrition, and psychiatric disorders such as depression (Albert et al., 1989 [**Level III**]; Gaspar, 1988 [**Level IV**]; Warren et al., 1994 [**Level IV**])
- Presence of comorbidities: more than four chronic health conditions (Lavizzo-Mourey, Johnson, & Stolley, 1988 [**Level IV**])
- Prescription drugs: number and types (Lavizzo-Mourey, Johnson, & Stolley, 1988 [**Level IV**])
- Past history of dehydration, repeated infections (Mentes, 2006 [**Level IV**])

Physical assessments (Mentes & IVANRC, 2000 [**Level I**])

- Vital signs
- Height and weight
- Body mass index (BMI) (Vivanti et al., 2008 [**Level IV**])
- Review of systems
- Indicators of hydration

Laboratory tests

- Urine-specific gravity (Mentes, 2006 [**Level IV**]; Wakefield et al., 2002 [**Level IV**])
- Urine color (Mentes, 2006 [**Level IV**]; Wakefield et al., 2002 [**Level IV**])
- Blood urea nitrogen (BUN)/creatinine ratio
- Serum sodium
- Serum osmolality
- Salivary osmolality
- Individual fluid intake behaviors (Mentes, 2006 [**Level IV**])

## **Nursing Care Strategies**

### **Risk Identification** (Mentes & IVANRC, 2000 [Level I])

- Identify acute situations: vomiting, diarrhea, or febrile episodes
- Use a tool to evaluate risk: Dehydration Risk Appraisal Checklist

### **Acute Hydration Management**

- Monitor input and output (Weinberg et al., 1994 [Level I]).
- Provide additional fluids as tolerated (Weinberg et al., 1994 [Level I]).
- Minimize fasting times for diagnostic and surgical procedures (American Society of Anesthesiologists, 1999 [Level I]).

### **Ongoing Hydration Management**

- Calculate a daily fluid goal (Mentes & IVANRC, 2000 [Level I]).
- Compare current intake to fluid goal (Mentes & IVANRC, 2000 [Level I]).
- Provide fluids consistently throughout the day (Ferry, 2005 [Level VI]; Simmons, Alessi, & Schnelle, 2001 [Level II]).
- Plan for at-risk individuals
- Fluid rounds (Robinson & Rosher, 2002 [Level IV]).
- Provide two 8-oz. glasses of fluid, one in the morning and the other in the evening (Robinson & Rosher, 2002 [Level IV]).
- "Happy hours" to promote increased intake (Musson et al., 1990 [Level V]).
- "Tea time" to increase fluid intake (Mueller & Boisen, 1989 [Level V]).
- Offer a variety of fluids throughout the day (Simmons, Alessi, & Schnelle, 2001 [Level II]).
- Fluid regulation and documentation
- Teach able individuals to use a urine color chart to monitor hydration status (Armstrong et al., 1994 [Level IV]; Armstrong et al., 1998 [Level IV]; Mentes, 2006 [Level IV]).
- Document a complete intake recording including hydration habits (Mentes & IVANRC, 2000 [Level I]).
- Know volumes of fluid containers to accurately calculate fluid consumption (Burns, 1992 [Level IV]; Hart & Adamek, 1984 [Level III]).

### **Follow-up Monitoring of Condition**

- Urine color chart monitoring in patients with better renal function (Armstrong et al., 1994 [Level IV]; Armstrong et al., 1998 [Level IV]; Wakefield et al., 2002 [Level IV]).
- Urine specific-gravity checks (Armstrong et al., 1994 [Level IV]; Armstrong et al., 1998 [Level IV]; Wakefield et al., 2002 [Level IV]).
- 24-hour intake recording (Metheny, 2000 [Level VI]).

## **1a.4.3. Grade assigned to the quoted recommendation with definition of the grade:**

### **Levels of Evidence**

**Level I:** Systematic reviews (integrative/meta-analyses/clinical practice guidelines based on systematic reviews)

**Level II:** Single experimental study (randomized controlled trials [RCTs])

**Level III:** Quasi-experimental studies

**Level IV:** Non-experimental studies

**Level V:** Care report/program evaluation/narrative literature reviews

**Level VI:** Opinions of respected authorities/consensus panels

AGREE Next Steps Consortium (2009). Appraisal of guidelines for research & evaluation II. Retrieved from <http://www.agreetrust.org/?o=1397>.

Adapted from: Melnyck, B. M. & Fineout-Overholt, E. (2005). Evidence-based practice in nursing & health care: A guide to best practice. Philadelphia, PA: Lippincott Williams & Wilkins and Stetler, C.B., Morsi, D., Rucki, S., Broughton, S., Corrigan, B., Fitzgerald, J., et al. (1998). Utilization-focused integrative reviews in a nursing service. Applied Nursing Research, 11(4) 195-206.

## **1a.4.4. Provide all other grades and associated definitions for recommendations in the grading system. (Note: If separate grades for the strength of the evidence, report them in section 1a.7.)**

**1a.4.5.** Citation and URL for methodology for grading recommendations *(if different from 1a.4.1)*:

Not applicable.

**1a.4.6.** If guideline is evidence-based (rather than expert opinion), are the details of the quantity, quality, and consistency of the body of evidence available (e.g., evidence tables)?

☐ Yes → **complete section 1a.7**

☒ No → **report on another systematic review of the evidence in sections 1a.6 and 1a.7; if another review does not exist, provide what is known from the guideline review of evidence in 1a.7**

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**1a.5. UNITED STATES PREVENTIVE SERVICES TASK FORCE RECOMMENDATION**

**1a.5.1.** Recommendation citation *(including date)* and URL for recommendation *(if available online)*:

Not applicable

**1a.5.2.** Identify recommendation number and/or page number and quote verbatim, the specific recommendation.

Not applicable

**1a.5.3.** Grade assigned to the quoted recommendation with definition of the grade:

Not applicable

**1a.5.4.** Provide all other grades and associated definitions for recommendations in the grading system. *(Note: the grading system for the evidence should be reported in section 1a.7.)*

Not applicable

**1a.5.5.** Citation and URL for methodology for grading recommendations *(if different from 1a.5.1)*:

Not applicable

**Complete section 1a.7**

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**1a.6. OTHER SYSTEMATIC REVIEW OF THE BODY OF EVIDENCE**

**1a.6.1.** Citation *(including date)* and URL *(if available online)*:

Not applicable

**1a.6.2.** Citation and URL for methodology for evidence review and grading *(if different from 1a.6.1)*:

**Complete section 1a.7**

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**1a.7. FINDINGS FROM SYSTEMATIC REVIEW OF BODY OF THE EVIDENCE SUPPORTING THE MEASURE**

*If more than one systematic review of the evidence is identified above, you may choose to summarize the one (or more) for which the best information is available to provide a summary of the quantity, quality,*

and consistency of the body of evidence. Be sure to identify which review is the basis of the responses in this section and if more than one, provide a separate response for each review.

**1a.7.1.** What was the specific structure, treatment, intervention, service, or intermediate outcome addressed in the evidence review?

Not applicable

**1a.7.2.** Grade assigned for the quality of the quoted evidence with definition of the grade:

**1a.7.3.** Provide all other grades and associated definitions for strength of the evidence in the grading system.

**1a.7.4.** What is the time period covered by the body of evidence? (*provide the date range, e.g., 1990-2010*). Date range: [Click here to enter date range](#)

#### QUANTITY AND QUALITY OF BODY OF EVIDENCE

**1a.7.5.** How many and what type of study designs are included in the body of evidence? (*e.g., 3 randomized controlled trials and 1 observational study*)

Not applicable

**1a.7.6.** What is the overall quality of evidence across studies in the body of evidence? (*discuss the certainty or confidence in the estimates of effect particularly in relation to study factors such as design flaws, imprecision due to small numbers, indirectness of studies to the measure focus or target population*)

Not applicable

#### ESTIMATES OF BENEFIT AND CONSISTENCY ACROSS STUDIES IN BODY OF EVIDENCE

**1a.7.7.** What are the estimates of benefit—magnitude and direction of effect on outcome(s) across studies in the body of evidence? (*e.g., ranges of percentages or odds ratios for improvement/decline across studies, results of meta-analysis, and statistical significance*)

Not applicable

**1a.7.8.** What harms were studied and how do they affect the net benefit (benefits over harms)?

Not applicable

#### UPDATE TO THE SYSTEMATIC REVIEW(S) OF THE BODY OF EVIDENCE

**1a.7.9.** If new studies have been conducted since the systematic review of the body of evidence, provide for each new study: 1) citation, 2) description, 3) results, 4) impact on conclusions of systematic review.

Not applicable

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## 1a.8 OTHER SOURCE OF EVIDENCE

*If source of evidence is NOT from a clinical practice guideline, USPSTF, or systematic review, please describe the evidence on which you are basing the performance measure.*

### 1a.8.1 What process was used to identify the evidence?

**Literature Review.** Formal environmental scans of the literature, including routine Pub-Med searches are performed to continually update evidence. The current evidence review results presented below include two time periods:

1. The first review searched PubMed and Cochrane Databases for articles published between October 2007 - October 2012. Search terms were “Dehydration[MeSH] and “Hospitalization[MeSH]”.
2. The second review searched PubMed, AHRQ and CMS websites for articles and reports published between October 2012 – present. Search terms included, (dehydration[MeSH] AND hospital\*) AND (prevent\* OR “access to care” OR “ambulatory care sensitive” OR small area analysis[MeSH]). We also tested more inclusive search strings. In addition we conducted two broad searches for literature addressing ambulatory care sensitive conditions and observation stays for literature that addressed dehydration in these contexts.

**Structured Panel Review.** A second source of evidence is from a 2009 structured clinical panel review of the indicator.<sup>1</sup> This review was held in context of evaluating the expansion of the AHRQ Prevention Quality Indicators to alternative denominator populations and provides the opinion of one stakeholder group: clinicians. The panel used a modified Delphi approach to evaluate the indicators, using a method that combined a nominal group technique and a Delphi technique. Panelists consisted of generalist and specialist physicians, nurses and allied health professionals. All panelists rated the indicators and received feedback from other panelists. The nominal group participated in a conference call to discuss the indicators and the discussion was summarized and distributed to all panelists before final rating. The final nominal group consisted of 23 panelists and the Delphi group consisted of 42 panelists. The purpose of the hybrid technique was to maximize various viewpoints and information exchange. Panelists rated the indicators on usefulness for various applications of the indicators, including area-level measurement for comparative reporting.

1. Davies S, McDonald KM, Schmidt E, Geppert J, Romano PS. Expanding the uses of AHRQ’s Prevention Quality Indicators: Validity from the clinician perspective. *Med Care*. Aug 2011; 49(8): 679-685.

### 1a.8.2. Provide the citation and summary for each piece of evidence.

#### Literature based evidence

##### **Impact**

We identified seven studies demonstrating that dehydration is a relatively common reason for hospitalization among the general and special populations. Wakefield and colleagues, using case-control methods, evaluated the risk factors and outcomes associated with hospital admission for dehydration between 1995 and 2000 in the Iowa City Veterans Affairs (VA) Medical Center.<sup>1</sup> Of the 27,242 hospital admissions, 149 patients (overall prevalence rate = 0.55%) were admitted with



dehydration. From 1995 to 2000, the percentage of patients admitted for dehydration increased from 0.3% to 0.8%.

One study examined the association between patient characteristics and hospitalization for ACSCs in the adult and pediatric population in Victoria, Australia during 2003 – 2004. The top five adult ACSC admissions and number of episodes were: diabetes complications (N = 55,007), chronic obstructive pulmonary disease (N = 13,555), dehydration and gastroenteritis (N = 12,145), congestive heart failure (N = 11,676) and angina (N = 11,130).<sup>2</sup>

In a retrospective cross-sectional study of the 2003 – 2008 Healthcare Cost and Utilization Project (HCUP) Nationwide Inpatient Sample (NIS) of adults aged 18– 64, 182,423 of which had a secondary diagnosis of schizophrenia, found a positive association between schizophrenia and hospitalization for dehydration (OR 1.67, 95% CI 1.58-1.66).<sup>3</sup>

An additional analysis of HCUP NIS data from 2005 to 2010 found that in adults age 18 and older, the age- and sex-risk adjusted rate of potentially preventable hospitalization for dehydration declined 38% between those years, from 118 per 100,000 population in 2005 to 73 per 100,000 population in 2010 ( $p < 0.05$ ). Total hospital costs for dehydration hospitalizations over that period declined 32% from \$1.6 to \$1.1 billion (in 2010 dollars,  $p < 0.05$ ).<sup>4</sup>

An analysis of HCUP SID data for 2003, 2005 and 2007 found that observed rates of hospital stays for dehydration were nearly 10 times higher among older adults age 65 and older (53.8 stays per 100,000 population in 2003) compared to younger adults age 18 to 64 (5.5 stays per 100,000 in 2003). Over the period examined (2003-2007), rates of hospital stays for dehydration declined a little faster among older adults (20%) compared to younger adults (16%).<sup>5</sup>

An analysis of 2008 HCUP State Inpatient Database (SID) and Medicare data for 27 states showed that dual-eligible beneficiaries (those eligible for both Medicare and Medicaid) accounted for 20.1% of all potentially preventable hospitalizations for dehydration by Medicare beneficiaries. Among all adults, the rate of potentially preventable hospitalizations for dehydration was significantly higher among dual-eligible beneficiaries compared to non-dual eligible Medicare beneficiaries (410 vs. 382 per 100,000 enrollees, or 9.6% higher among dual-eligibles). However, when examined by age group, rates of hospitalization for dehydration were higher among non-dual eligible enrollees for those aged 85 and older (886 vs. 1154 hospitalizations per 100,000 enrollees, dual vs. non-dual). Rates were similar for other age strata, except age 65 to 74, where the rate among dual eligibles was much higher than among non-dual eligibles (354 vs. 196 hospitalizations per 100,000 enrollees).<sup>6</sup>

The same study found that in 2008, potentially preventable hospitalizations for dehydration by Medicare beneficiaries cost a total of \$560 million in 2008, of which 20.9% of costs were for dual-eligible beneficiaries. Average costs per hospital stay for dehydration were 5.6% higher among dual-eligible compared to non-dual eligible beneficiaries (\$5,860 vs \$5,550 per stay).<sup>6</sup>

A separate analysis of linked Medicare and Medicaid data found that dehydration accounted for 14.7% of all potentially avoidable hospitalizations (PAH) by dual eligible beneficiaries in 2005. Dehydration accounted for an even larger share of PAHs for dual eligible beneficiaries enrolled in home- and community-based services (18.4% of all PAHs) and living in the community or other unspecified settings (17.7%). Dehydration accounted for a smaller proportion of PAHs for those dual eligible beneficiaries living in nursing facilities (10.3%) or skilled nursing facilities (12.9%).<sup>7</sup>

1. Wakefield BJ, Menten J, Holman JE, Culp K. Risk factors and outcomes associated with hospital admission for dehydration. *Rehabilitation Nursing*. 2008;33(6):233-241.

2. Ansari Z, Haider SI, Ansari H, de Gooyer T, Sindall C. Patient characteristics associated with hospitalisations for ambulatory care sensitive conditions in Victoria, Australia. *BMC health services research*. 2012;12:475.
3. Cahoon EK, McGinty EE, Ford DE, Daumit GL. Schizophrenia and potentially preventable hospitalizations in the United States: a retrospective cross-sectional study. *BMC psychiatry*. 2013;13:37.
4. Torio C, Elixhauser A, Andrews R. *Trends in Potentially Preventable Admissions among Adult and Children, 2005-2010*. Rockville, MD: Agency for Healthcare Research and Quality;2013.
5. Stranges E, Friedman B. *Trends in Potentially Preventable Hospitalization Rates Declined for Older Adults, 2003-2007*. Rockville, MD: Agency for Healthcare Research and Quality;2009.
6. Jiang HJ, Wier LM, Potter DEB, Burgess J. *Hospitalizations for Potentially Preventable Conditions among Medicare-Medicaid Dual Eligibles, 2008*. Rockville, MD: Agency for Healthcare Research and Quality;2010.
7. Segal M. *Dual Eligible Beneficiaries and Potentially Avoidable Hospitalizations*. Washington, DC: Centers for Medicare and Medicaid Services;2011.

### **Variation in performance**

The 1995 -2000 Wakefield study (described earlier) at the Iowa City Veterans Affairs (VA) Medical Center VA reported a lower rate of hospitalizations due to dehydration (0.3-0.8%) compared to the 1.4% reported by Warren and colleagues in 1994 for Medicare admissions.<sup>1</sup> Authors attributed the lower VA rate to efforts to improve outpatient care in this population.

1. Wakefield BJ, Menten J, Holman JE, Culp K. Risk factors and outcomes associated with hospital admission for dehydration. *Rehabilitation Nursing*. 2008;33(6):233-241.

### **Clinical evidence**

Of the 149 patients admitted to VA Medical Center in Iowa between 1995 and 2000 (described earlier), researchers had clinical data on 93 cases (62%).<sup>1</sup> Compared with control patients, patients admitted with hypo-osmolality or hyponatremia (ICD-9-CM code 276.1) had lower temperature, sodium (outside the range of normal), chloride (outside the range of normal), and urine-specific gravity and were significantly more likely to be constipated, have generalized weakness, have altered urine output, and be taking thiazide diuretics. Patients admitted with volume depletion (ICD-9-CM code 276.5) had lower weight, body mass index, blood pressure, sodium, and higher pulse rates. They were also more likely to have generalized weakness, diarrhea, or vomiting, been NPO before admission, and be taking a bulk-forming laxative and were less likely to have edema. Almost none of the patients in this population were admitted for hyponatremia.

Several studies have examined readmissions among individuals with gastrointestinal surgeries or diagnoses. Messaris *et al* evaluated the reasons for readmission for patients that had undergone a diverting ileostomy procedure between 1990 and 2010 using the Colon and Rectal Surgery Division Patient Database of a Medical Center in Hershey, Pennsylvania.<sup>8</sup> The 60-day readmission rate was 16.9% (n=102), of which the most common cause was dehydration (n=44, 43.1%) Diuretic use was the sole independent factor associated with readmission due to dehydration (p=.0001). A single institution study that examined patients discharged for 7 months following the implementation of the “Ileostomy Pathway” a patient education program, toolkit and visiting nurse services, compared to the 4 years prior to implementation found that dehydration-related readmissions decreased from 15.5% to 0% after implementation. The education program included self-care instructions, medication reconciliation, coordination of follow-up appointments and care, a toolkit including care instructions, ostomy supplies

and prescriptions, input and output measurement chart, a urinal, and instructions on preventing dehydration.<sup>9</sup> A single institution study of 154 patients undergoing ileostomy construction found that 20% were readmitted for dehydration (41% of all readmissions). Older age, cancer chemotherapy and being discharged on antidiarrheals increased risk of readmission for dehydration.<sup>10</sup> In a study of 460 patients with Inflammatory Bowel Disease and 595 admission episodes, 14% of admissions and 24.7% of readmissions were for dehydration.<sup>11</sup>

In a retrospective study of patients admitted to the emergency department of a large tertiary university hospital in Switzerland during one month in 2012, Arampatzis *et al* investigated the prevalence of hypo- and hypernatremia.<sup>12</sup> They reported 524 (17%) of all patients showed dysnatraemia on admission. Of these, only 4 patients (1%) had hyponatremia as their main admission diagnosis and were neurologically symptomatic on admission, compared to 15 patients (12%) admitted for hypernatremia with 8 being neurologically symptomatic on admission.

One study identified interventions for individuals at risk for dehydration. A retrospective review of 308 home parenteral nutrition (HPN) or home intravenous fluid (HIVF) patients found that protocols to detect early dehydration through laboratory tests and symptom education and subsequent treatment with HIVF found that 63% of patients with HPN or HIVF required additional HIVF. This resulted in the successful treatment of 170 episodes of dehydration at home, 9 ED visits and 22 admissions. Of those that required admission, older patients were more likely to have multiple dehydration episodes (55.5 +/- 15.8 years vs. 48.4 +/- 13.7 years,  $p=.021$ ) Those with multiple readmissions were documented as not having HIVF on hand as ordered, lack of insurance covering HIVF or refusal to follow infusion schedule. This study did not provide a control for comparison.<sup>13</sup> The Program of All-Inclusive Care for the Elderly (PACE) study was a large, 61-site study of a community-based support program for frail elderly, including long-term care services and supports and comprehensive medical care to individuals qualifying for state nursing home eligibility. Comparisons between the PACE and Medicaid waiver programs were particularly noteworthy for dehydration. The Potentially Avoidable Hospitalizations (PAH) rate for dehydration was 11 stay per 1,000 person-years in PACE and 46 stays per 1,000 person-years in the waiver population. PAHs were defined as hospitalizations for conditions that previously-established criteria have identified as possibly preventable or manageable without hospitalization. Hospitalizations due to dehydration were also considerably higher in dual-eligible Medicaid nursing home populations (35/1,000 person-years) than in PACE (11/1,000 person-years).<sup>14</sup>

There is the potential for observation stays to substitute for inpatient care. We identified no studies that specifically examined observation stays as a substitute for inpatient care. In a retrospective analysis of a 2002-2011 large administrative claims database of commercially insured individuals in the U.S., fewer than 1% of observation stays had a diagnosis of hypovolemia.<sup>15</sup> Ross *et al* conducted a retrospective analysis of observation stays from three distinct data sources: a case study of observation units in Atlanta, Georgia (2010); statewide discharge data for Georgia (2010); and national survey and discharge data (2009 – 2010). They found that in all three settings, dehydration or fluid and electrolyte disorders were the third most common condition managed in observation services.<sup>16</sup>

Three articles investigated the impact of atmospheric heat and changing weather conditions on hospital or emergency department visits. In the only U.S. study, researchers investigated the associated between atmospheric temperature and hospital admissions along with mitigating factors (such as air conditioner ownership) in California from 1999 to 2005.<sup>17</sup> Authors observed a significantly increased risk of hospitalization for multiple diseases, including dehydration [2.6 %, 95% CI (-0.5, 5.7)] and acute renal failure, with a 10 degree Fahrenheit increase in same-day ambient temperature. Air conditioner ownership and usage significantly reduced the effects of temperature on all health outcomes after controlling for potential confounding by family income and other socioeconomic factors. Additionally, a

10% increase in air conditioner ownership was associated with reduced dehydration mortality [absolute reduction = 1.3%, 95% CI (0.6, 2.0); relative reduction = 11.5%, 95% CI (4.9, 18.1)].

In the first foreign study reviewed, authors utilized a syndromic surveillance system to detect the health impacts of the 2006 heat wave in France through variations in Emergency Department (ED) activity over time.<sup>18</sup> They found that although the number of admissions for all health conditions remained equal between the 'on alert' and 'off alert' periods (4,557.7 vs. 4,511.2 visits per day), the number of elderly patients increased significantly during the 'on alert' period relative to the 'off alert' period (476.7 vs. 446.2 visits per day,  $p < 0.05$ ). Patients presenting to the ED with dehydration were observed at a significantly higher daily frequency during 'on alert' (12.6) than 'off alert' days (4.3) ( $p < 0.001$ ). The corresponding increase in ED visits for the elderly (aged 75 years or older) admitted with dehydration increased from 0.63% to 1.88% ( $p < 0.001$ ) during the same time period.

Using a case-only design, researchers Khalaj et al studied the health impacts of heat waves in five regions of New South Wales, Australia 2010.<sup>19</sup> They found that during extreme heat events, the odds of emergency hospital admission due to dehydration (Odds Ratio [OR] = 1.56; 95% confident interval [CI]: 1.30-1.88) and other disorders of fluid, electrolyte and acid-base balance (OR = 1.29; 95%CI: 1.05-1.58) increased significantly, compared to admission for other causes.

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## Disparities in Care

Australian researchers reported that several patient groups were more susceptible to an extreme heat events and therefore more likely to be admitted to an emergency hospital for dehydration during such events: those with (1) underlying mental and behavioral disorders; (2) diseases of nervous and circulatory system, especially cardiac; (3) diseases of the respiratory system, especially asthma and chronic obstructive pulmonary disease; (4) neoplasms and renal disease, especially renal failure; and (5) children under 4-years of age.<sup>19</sup> Wakefield and colleagues, using data from a VA Medical Center in Iowa, reported a mean age of 64 years (standard deviation [SD] 16) among the 124 (4%) patients with hyponatremia on admission.<sup>1</sup> Of these, 56% of the hyponatremic patients were male. Of the 400 patients (13%) who were hypernatremic, the mean age was 53 years [SD 22] and 59% were male. Of the 124 hyponatremic patients, 40 (32%) were admitted for surgical and 84 (68%) for medical reasons compared to 182 (46%) and 218 (54%) of the hypernatremic patients.

An analysis of 2008 HCUP State Inpatient Database (SID) and Medicare data for 27 states found that nearly half (48.8%) of potentially preventable hospitalizations for dehydration among dual-eligible beneficiaries occurred in individuals age 65 to 84, with approximately one quarter each among those age 18 to 64 (26.1%) and age 85 and older (25.0%).<sup>6</sup> A majority of dehydration-related hospitalizations across all adults (age 18 and older) were in women (70.1%) and among White individuals (60.6%).

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## Results of Panel Review

During an assessment of the AHRQ Prevention Quality Indicators for various uses, including area-level comparative reporting, a clinical panel rated the indicator as useful with some concerns regarding use. Panelists noted that this indicator in particular may aid in exposing geographic areas with decreased access to care that may benefit from increased targeting of resources. Alternatively, some suggested that with the inclusion of gastroenteritis as a principal diagnosis, this indicator may serve a disease

surveillance function in the public health setting. Panelists were less confident in the current state of evidence linking access to quality care and hospitalizations for dehydration at the area-level. They noted that differences in the use of rehydration therapy in ambulatory settings, such as observation units, may impact rates. The panel noted that socioeconomic status risk adjustment may be better for some applications.<sup>20</sup> This review was specific to the clinician perspective and did not include other stakeholders.

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